

## REMARKS

Claims 1-10, 12-14, 16-32, 34-48 and 50-51 are pending in the present application. By this amendment, Claims 1, 19-20, 22, 34 and 43 are amended; and Claims 15 and 33 are canceled. Applicants respectfully request consideration of the present claims in view of the foregoing amendments and the following remarks.

### **I. Formal Matters:**

#### Response To Claim or Rejections Under 35 U.S.C. § 112

Claims 1-10 and 12-33 stand rejected under 35 U.S.C. § 112 as allegedly being indefinite because these claims recite "less than about 90°C". Applicants have amended the independent claims to recite "less than 90°C." As such, Applicants respectfully submit that the claims are now properly dependent and request withdrawal of this rejection.

Claims 1-10, 12-14, 16-21, 34-48 and 50-51 stand rejected under 35 U.S.C. § 112, for allegedly being indefinite as to the metes and bounds of the limitations of the invention. Specifically, the Examiner states that the temperature and time are not defined. Applicants respectfully traverse this rejection. The temperature has been defined. The temperature is set forth in the specification as the time needed, and this time will vary depending on various factors including, at least, the actual solution used and the desired final characteristics. However, to expedite prosecution, Applicants have amended the claims to add a time period. As such, Applicants respectfully submit that the claims are now properly dependent and request withdrawal of this rejection.

#### Allowable Subject Matter

Applicants wish to thank the Examiner for indicating that Claims 19 and 20 would be allowable if rewritten in independent form. Applicants have amended Claims 19 and 20 as requested. Accordingly, it is respectfully submitted that Claims 19 and 20 are now in condition for allowance.

### **II. Prior Art Rejections:**

Claims 1-3, 7-10, 12-18, 22-23, 25-29 and 31-32 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over the article by M.Z.C. Hu et al., "Nucleation and Growth for Synthesis of Nanometric Zirconia Particles by Forced Hydrolysis", J. of

Colloid and Interface Science, 198:87-99 (1998) (hereinafter "Hu"). This rejection is respectfully traversed.

Claim 1 is directed, *inter alia*, to a method of sol-gel processing using an inorganic metal salt and a mixed solvent system, comprising preparing a solution including an inorganic metal salt, water, and an organic solvent having a metal salt concentration and a volume ratio of organic solvent to water; incubating the solution at a temperature less than 90° C for a period of time; wherein the metal salt concentration, volume ratio of organic solvent to water, temperature, and time are selected to provide a sol or a gel having desired characteristics; wherein the sol or the gel is capable of forming a coating; wherein the volume ratio of organic solvent to water ranges from about 1/1 to 10/1; and wherein nanosized particles are produced; wherein the time ranges from about one minute to about 72 hours. Claim 22 is directed, *inter alia*, to a method of producing nanosize particles using an inorganic metal salt and a mixed solvent system, comprising preparing a solution including an inorganic metal salt, water, and an organic solvent having a metal salt concentration and a volume ratio of organic solvent to water; incubating the mixture at a temperature less than 90°C for a period of time; wherein the metal salt concentration, volume ratio of organic solvent to water, temperature, and time have been manipulated to provide primary particles in the solution having a diameter of about 10 nm to about 100 nm; wherein the primary particles are capable of forming a sol-gel coating; and wherein the volume ratio of organic solvent to water ranges from about 1/1 to 10/1; wherein the time ranges from about one minute to about 72 hours. Claim 34 is directed, *inter alia*, to a method of producing a sol from an inorganic metal salt at room temperature comprising preparing a solution including an inorganic metal salt, water, and an organic solvent having a metal salt concentration and a volume ratio of organic solvent to water; incubating the solution at room temperature for a period of time; wherein the metal salt concentration, volume ratio of organic solvent to water, and time are selected to provide a sol having desired characteristics; wherein the sol is capable of forming a coating; wherein the volume ratio of organic solvent to water ranges from about 1/1 to about 10/1; and wherein the sol contains nanosized particles; wherein the time ranges from about one minute to about 72 hours. Claim 43 is directed, *inter alia*, to a method of producing monodispersed particles at room temperature, comprising preparing a solution including an inorganic metal salt, water, and an organic solvent having a metal salt concentration and a volume ratio of organic solvent to water; incubating the solution at room temperature for a period of time; wherein the metal salt concentration, volume ratio of organic solvent to water, and time are selected to provide a sol having desired characteristics; wherein the sol is capable of forming a coating;

wherein drying the sol to produce a powder of monodisperse particles; and wherein the volume ratio of organic solvent to water ranges from about 1/1 to about 10/1.

The Examiner alleges that Hu discloses methods of making nanoparticles by mixed solvent nucleation and growth of zirconia particles.

It is respectfully submitted that Hu fails to teach or suggest Applicants' claimed invention. Hu is directed to the formation of particles, not sols or gels. As Hu never discusses the formation of sols or gels anywhere in the article, Hu cannot be said to teach these materials or any of their applications, such as coatings. Since Applicants invention, as now claimed, requires that the sols and/or gels be capable of being used in coating applications, and as sols and/or gels are never disclosed in Hu, Applicants respectfully submit that Hu fails to teach or suggest Applicants' claimed invention.

Hu is directed to the possibility of using the solutions disclosed to induce particle growth. The present application is directed to sol-gel coating applications. The present application covers the entire spectrum of sol-gel applications and not simply the inducement of particle growth. Applicants' inorganic salt is used as a precursor to sol-gel formation, not simply particle growth. The sol-gels are the final state that can be used in coating applications. These sol-gels and these coating applications are not taught or suggested anywhere in Hu.

Hu is directed to showing that when alcohol is added to an aqueous solution, the alcohol may increase the kinetics of the process, thereby inducing particle growth. However, there is no teaching or suggestion that this alcohol addition will lead to sol-gel processing using an inorganic salt. This is Applicants' claimed process. The physical phenomena required to obtain sol-gel materials capable of being used in coating applications are not recognized in Hu. Since Hu only teaches that alcohol increases nucleation growth formation kinetics, it cannot be argued that Hu teaches or suggests sol-gel formation since these phenomena are not recognized.

For at least the reasons given above, Applicants respectfully submit that Claims 1 and 22 are allowable over the art of record. Furthermore, since Claims 2-3, 7-10, 12-18, 23, 25-29 and 31-32 recite additional claim features and depend from either Claim 1 or Claim 22, these claims are also allowable over the art of record. Accordingly, Applicants respectfully request withdrawal of this rejection.

Claims 4-6, 21, 24 and 30 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Hu in view of Y.T. Moon et al., "Preparation of Monodispersed and Spherical Zirconia Powders by Heating of Alcohol-Aqueous Salt Solutions", J. Am.

Ceram. Soc., 78(10): 2690-2694 (1995) (hereinafter "Moon"). This rejection is respectfully traversed.

Applicants' claimed invention may be relied upon as above.

Applicants' discussion of Hu may be relied upon as above.

The Examiner alleges that Moon discloses methods of making monodispersed  $\text{ZrO}_2$  particles from zirconyl chloride solutions.

It is respectfully submitted that the combination of Hu and Moon fails to teach or suggest Applicants' claimed invention. Moon fails to remedy the deficiencies of Hu. Moon's article is clearly different from Applicants' invention as claimed since Moon only discloses producing a ceramic powder via microwave heating. Applicants' claimed invention is directed to the physical phenomena required to obtain sol-gels capable of being used in coating applications. Moon does not teach or suggest sol-gel processing or sol-gel coatings as Moon does not recognize these physical phenomena since Moon is only directed to powders. Moon does not address the particle connectivity that is present in a porous gel network, particle morphology or particle hardness as does the sol-gel processing of the claimed invention. See Examples.

In contrast Applicants' claimed invention is not directed to powder formation, rather Applicant's invention is directed to producing a sol or a gel containing dispersed particles which are useful in coatings and films. The claimed method is unique in sol-gel coating applications with inorganic metal salt precursors. See Example 10 illustrating the capability of the methods of achieving sol and gel processing in inorganic metal salt solutions of mixed alcohol-water solvent. The teachings of Moon and Hu simple show that alcohol may be used to induce nucleation growth formation kinetics. There is no teaching whatsoever of sol-gel coatings or application in either Moon or Hu since neither Moon nor Hu teach or suggest the physical phenomena needed for sol-gel formation. Applicants, as claimed, recognize the variables needed for sol-gel production. Since these variables are not taught or suggested by Moon or Hu, it is respectfully submitted that the combination of Moon and Hu fails to teach or suggest Applicants' claimed invention.

For at least the reasons given above, Applicants respectfully submit that Claims 1 and 22 are allowable over the art of record. Furthermore, since Claims 4-6, 21, 24 and 30 recite additional claim features and depend from either Claim 1 or Claim 22, these claims are also allowable over the art of record. Accordingly, Applicants respectfully request withdrawal of this rejection.

**III. Double Patenting Rejections:**

Claims 42-48 and 50-51 were rejected under the judicially created doctrine of obviousness-type double patenting over claims 1-6 of U.S. Patent Number 6,264,912 to Hu. Applicants submit that the present invention differs from the patented claims in the above-referenced U.S. patent. However, Applicants submit herewith a terminal disclaimer, disclaiming an extension of the patent term, if any, of the present invention beyond the patent term of the above-referenced U.S. patent to expedite allowance of the present claims.

**IV. Conclusion:**

For at least the reasons given above, Applicants respectfully submit that Claims 1-10, 12-14, 16-32, 34-48 and 50-51 define patentable subject matter. Accordingly, Applicants respectfully request allowance of these claims.

The foregoing is submitted as a full and complete Response to the First Office Action mailed June 14, 2002, and early and favorable consideration of the claims is requested.

Should the Examiner believe that anything further is necessary in order to place the application in better condition for allowance, the Examiner is respectfully requested to contact Applicants' representative at the telephone number listed below.

A check in the amount of \$400 is enclosed for a two-month extension of time. No additional fees are believed due; however, the Commissioner is hereby authorized to charge any deficiency, or credit any overpayment, to Deposit Account No. 11-0855.

Respectfully submitted,



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**AMENDMENTS IN THE APPLICATION:**

In accordance with 37 C.F.R. 1.121(c), the following changes to the claims as rewritten by the foregoing amendment show all of the changes made relative to the previous versions of the claims.

**In the Claims:**

Please cancel Claims 15 and 33

Please amend the claims as follows:

1. (Twice Amended) A method of sol-gel processing using an inorganic metal salt and a mixed solvent system, comprising:

preparing a solution including an inorganic metal salt, water, and an organic solvent having a metal salt concentration and a volume ratio of organic solvent to water;

incubating the solution at a temperature less than [about] 90° C for a period of time;

wherein the metal salt concentration, volume ratio of organic solvent to water, temperature, and time are selected to provide a sol or a gel having desired characteristics;

wherein the sol or the gel is capable of forming a coating;

wherein the volume ratio of organic solvent to water ranges from about 1/1 to 10/1; and

wherein nanosized particles are produced;

wherein the time ranges from about one minute to about 72 hours.

19. (Amended) [The method of claim 1] A method of sol-gel processing using an inorganic metal salt and a mixed solvent system, comprising:

preparing a solution including an inorganic metal salt, water, and an organic solvent having a metal salt concentration and a volume ratio of organic solvent to water;

incubating the solution at a temperature less than 90° C for a period of time;

wherein the metal salt concentration, volume ratio of organic solvent to water, temperature, and time are selected to provide a sol or a gel having desired characteristics;

wherein the sol or the gel is capable of forming a coating;

wherein the volume ratio of organic solvent to water ranges from about 1/1 to 10/1; and

wherein nanosized particles are produced;

wherein the time ranges from about one minute to about 72 hours;

wherein the temperature ranges from about 20 °C to about 25 °C and wherein nanosized particles are produced.

20. (Amended) [The method of claim 1] A method of sol-gel processing using an inorganic metal salt and a mixed solvent system, comprising:

preparing a solution including an inorganic metal salt, water, and an organic solvent having a metal salt concentration and a volume ratio of organic solvent to water;

incubating the solution at a temperature less than 90° C for a period of time;

wherein the metal salt concentration, volume ratio of organic solvent to water, temperature, and time are selected to provide a sol or a gel having desired characteristics;

wherein the sol or the gel is capable of forming a coating;

wherein the volume ratio of organic solvent to water ranges from about 1/1 to 10/1; and

wherein nanosized particles are produced;

wherein the time ranges from about one minute to about 72 hours;

wherein the temperature ranges from about 20 °C to about 25 °C and wherein monodispersed particles are produced.

22. (Twice Amended) A method of producing nanosize particles using an inorganic metal salt and a mixed solvent system, comprising:

preparing a solution including an inorganic metal salt, water, and an organic solvent having a metal salt concentration and a volume ratio of organic solvent to water;

incubating the mixture at a temperature less than [about] 90°C for a period of time;

wherein the metal salt concentration, volume ratio of organic solvent to water, temperature, and time have been manipulated to provide primary particles in the solution having a diameter of about 10 nm to about 100 nm;

wherein the primary particles are capable of forming a sol-gel coating;  
and

wherein the volume ratio of organic solvent to water ranges from about 1/1 to 10/1;

wherein the time ranges from about one minute to about 72 hours.

34. (Twice Amended) A method of producing a sol from an inorganic metal salt at room temperature comprising:

preparing a solution including an inorganic metal salt, water, and an organic solvent having a metal salt concentration and a volume ratio of organic solvent to water;

incubating the solution at room temperature for a period of time;

wherein the metal salt concentration, volume ratio of organic solvent to water, and time are selected to provide a sol having desired characteristics;

wherein the sol is capable of forming a coating;

wherein the volume ratio of organic solvent to water ranges from about 1/1 to about 10/1; and

wherein the sol contains nanosized particles;

wherein the time ranges from about one minute to about 72 hours.

43. (Twice Amended) A method of producing monodispersed particles at room temperature, comprising:

preparing a solution including an inorganic metal salt, water, and an organic solvent having a metal salt concentration and a volume ratio of organic solvent to water;

incubating the solution at room temperature for a period of time;

wherein the metal salt concentration, volume ratio of organic solvent to water, and time are selected to provide a sol having desired characteristics;

wherein the sol is capable of forming a coating;

wherein drying the sol to produce a powder of monodisperse particles; and

wherein the volume ratio of organic solvent to water ranges from about 1/1 to about 10/1;

wherein the time ranges from about one minute to about 72 hours.